4. SCOPE AND ROLE OF OPERABLE UNIT OR RESPONSE ACTION

The Operable Unit 5-12 Comprehensive RI/FS is the culmination of all of the CERCLA evaluations performed for WAG 5. According to the FFA/CO, the boundary of WAG 5 encompasses the facility locations presently or historically used within the PBF and ARA areas, immediately adjacent areas where waste activities may have taken place, and all surface and subsurface areas. The boundary of the PBF area is well defined by a perimeter fence that surrounds the entire PBF complex. However, the ARA does not have a perimeter fence.

The issuance of the ROD for OU 5-12, the comprehensive WAG 5 operable unit, marks the beginning of final remedial activities. As specified in the Action Plan attached to the FFA/CO (DOE-ID 1991), post-ROD activities will include remedial design/remedial action (RD/RA) phases. The RD/RA will commence with the development of a scope of work to identify and establish deadlines for submitting other documents and outline the overall strategy for managing the RD/RA. A draft scope of work will be submitted to EPA and IDHW for review within 21 days of the issuance of the ROD. Substantial continuous physical remedial action within WAG 5 will commence within 15 months of the issuance of the ROD.

The selected remedy for WAG 5 comprises remedial actions that are protective of human health and the environment. Three actions will be implemented to mitigate the unacceptable risks to human or ecological receptors associated with the seven specific sites identified in the WAG 5 Comprehensive RI/FS (Holdren et al. 1999) and Proposed Plan (DOE-ID 1999b). In addition, limited action comprising institutional controls at nine other sites, management of stored and investigation-derived waste, and groundwater monitoring are components of the selected remedy.

The first remedial action addresses the risk associated with a collection of five individual sites where contaminated soil is the only source medium (see Section 8). The soil sites are contaminated with radionuclides and toxic metals. However, based on the detected concentrations of the contaminants, the soil at these sites is not regulated under the Toxic Substance Control Act (TSCA) (40 CFR 761) or RCRA and is not identified as mixed waste.

The second action will be implemented to mitigate the risk posed by residual contamination in a sanitary waste system (see Section 9). Residual sludge in the seepage pit is the only waste present. The sludge is identified as mixed waste containing low levels of radionuclides and low concentrations of toxic metals and organics. The waste is not RCRA characteristic but is identified as RCRA F-listed (i.e., F-001) (40 CFR 261, Subpart D) waste based on knowledge that solvents were used in the facility (Holdren et al. 1999).

The only principal threat identified in WAG 5, addressed by the third remedial action, is posed by the contents of an underground storage tank (see Section 10). A principal threat is defined by the EPA as source material considered to be highly toxic or highly mobile that generally cannot be contained in a reliable manner or would present a significant risk to human health or the environment should exposure occur (EPA 1999a). Waste in the underground storage tank is classified as mixed waste that contains radionuclides, toxic metals, and organic compounds. The tank contents are classified as RCRA characteristic waste based on detected concentrations of trichloroethene and RCRA F-listed mixed waste based on process knowledge (Holdren et al. 1999). Because concentrations of the PCB Aroclor-1260 exceed 50 ppm, the waste also is regulated under TSCA.

Waste regulated under RCRA or TSCA is not associated with the nine sites identified for limited action (see Section 11). However, RCRA or TSCA requirements apply to mixed waste currently in storage at the ARA-II facility and also may apply to investigation-derived waste generated by implementing the selected remedy. Applicable or relevant and appropriate requirements for the stored and investigation-derived waste will be determined as the waste is characterized for final disposition.

5. GENERAL SITE CHARACTERISTICS

The general characteristics of WAG 5 are consistent with those found across the entire INEEL. These characteristics and the conceptual site models used to evaluate the risks associated with WAG 5 sites are summarized below. Site-specific information such as size, the nature and extent of contamination, and sampling results are described in Section 8 for the contaminated soil sites ARA-01, ARA-12, ARA-23, ARA-25, and PBF-16; Section 9 for the ARA-02 Sanitary Waste System; and Section 10 for the ARA-16 Radionuclide Tank.

5.1 Physical Characteristics

The INEEL is located on the Eastern Snake River Plain, a large topographic depression extending from the Oregon border across Idaho to Yellowstone National Park and northwestern Wyoming. The surface of the INEEL in general is covered by basalt flows and intermittent, discontinuous pockets of sediment. In the WAG 5 area, basalt flows are the dominant surface features and surface sediments are generally sparse and thin. The average surficial sediment thicknesses are 0.4 m (1.5 ft) at ARA and 3 m (10 ft) at PBF (Holdren et al. 1997).

The vadose zone is the unsaturated region extending from land surface down to the water table, and varies in thickness from approximately 61 m (200 ft) thick in the northern part of the INEEL to more than 274 m (900 ft) in southern portions of the Site (Irving 1993). Except for some areas adjacent to the Big Lost River, the vadose zone is a complex series of heterogeneous basalt flows and thin layers of interbedded sediments. The vadose zone is approximately 189 m (620 ft) thick beneath the ARA. At PBF, the average vadose zone thickness is 139 m (455 ft) but varies as much as 7 m (23 ft) within the immediate vicinity of PBF (DOE-ID 1997a). About 90% of the vadose zone is characterized by thick sequences of interfingered basalt flows. These sequences exhibit large void spaces resulting from fissures, rubble zones, lava tubes, undulatory basalt-flow surfaces, and fractures. Sedimentary interbeds in the vadose zone consist of sands, silts, and clays and are generally thin and discontinuous. Lithologic logs collected from wells drilled within WAG 5 indicate cumulative sediment thicknesses in the vadose zone ranging from 5.4 to 17.6 m (18 to 58 ft) beneath ARA and 3 to 13 m (10 to 42 ft) under the PBF (Holdren et al. 1999).

Perched water at the INEEL forms when the hydraulic conductivity of a vadose zone layer is sufficiently low to impede the vertical movement of water. Though perched water has been detected at other INEEL facilities, it has not been observed at WAG 5. The absence of perched water beneath WAG 5 may be related to the sedimentary interbeds that appear to be discontinuous and limited in areal extent. More likely, however, perched water has not developed at ARA or PBF because volumes of infiltrating water are not sufficient. Typically, the formation of perched water at the INEEL is associated with evaporation ponds.

Surface hydrology includes water from three streams that flow intermittently onto the INEEL and from local runoff caused by precipitation and melting snow. Ponds and streams do not exist within WAG 5 except very briefly in conjunction with runoff. The Big Lost River is the nearest surface water feature (see Figure 1) and is not influenced by activities at WAG 5. Because ARA is no longer operational, no evaporation ponds or other surface impoundments are available for process discharges. At PBF, the surface impoundment of process effluent has been discontinued and all liquid waste is collected in tanks or aboveground containment structures.

The Snake River Plain Aquifer underlies most of the INEEL. The aquifer, defined as the saturated region beneath the vadose zone, arcs approximately 354 km (220 mi) through the eastern Idaho subsurface and varies in width from approximately 80 to 113 km (50 to 70 mi). The total area is about

24,862 km^2 (9,600 mi^2). The depth to groundwater, synonymous with the thickness of the vadose zone, ranges from approximately 61 m (200 ft) below land surface in the north to more than 274 m (900 ft) in the south (Irving 1993). The aquifer contains numerous, relatively thin basalt flows extending to depths of 1,067 m (3,500 ft) below land surface. Like the vadose zone, the Snake River Plain Aquifer is characterized by sedimentary interbeds that are typically discontinuous. The aquifer has an estimated capacity of 2.5E+12 m^3 (8.8E+13 ft^3) of water, which is approximately equivalent to the amount of water contained in Lake Erie, or enough water to cover the entire State of Idaho to a depth of 1.2 m (4 ft) (Hackett, Pelton, and Brockway 1986).

The Snake River Plain Aquifer is recharged primarily by infiltration from precipitation and from deep percolation of irrigation water. Annual recharge rates depend largely on snowfall. Regional groundwater flows to the south-southwest; however, the flow direction can be affected locally by recharge from rivers, surface water spreading areas, and heterogeneity in the aquifer. Estimates of flow velocities within the aquifer range from 1.5 to 6.1 m/day (5 to 20 ft/day) (Irving 1993). Flow in the aquifer primarily is through fractures, through interflow zones in the basalt, and in the highly permeable rubble zones located at the tops of basalt flows. The aquifer is considered heterogeneous and anisotropic (having properties that differ depending on the direction of measurement) because of the permeability variations within the aquifer that are caused by basalt irregularities, fractures, void spaces, rubble zones, and sedimentary interbeds. The heterogeneity is responsible for the variability in transmissivity values (measures of the ability of the aquifer to transmit water). Transmissivity measurements in wells at the INEEL range from 1.0E-01 to 1.1E+06 m^2/day (1.1E+00 to 1.2E+07 ft^2/day) (Wylie et al. 1995). Concerns about groundwater contamination from INEEL operations have prompted an extensive monitoring system over the INEEL (Irving 1993). Over the vast majority of the INEEL, maximum contaminant levels are not exceeded.

The hydraulic gradient at WAG 5 was evaluated in 1996 and 1997 (Dustin 1996; Neher 1997a, 1997b) to support the WAG 5 Work Plan (DOE-ID 1997a). The evaluation included (1) collecting three quarterly groundwater elevation measurements from 20 wells in and around WAG 5 beginning in August 1996; (2) reviewing borehole lithology, deviation, and well construction for 37 wells in and around WAG 5 to develop water table contour maps; (3) evaluating barometric data during each groundwater monitoring event to determine potential barometric influences on the resulting water table contour maps; and (4) continuous monitoring of water levels in two wells at PBF for a period of 16 days to determine the effects, if any, from PBF production well pumping on the WAG 5 area water table. The results of the evaluation were used to develop the WAG 5 water table contour map presented in Figure 3. Well construction, barometric effects on water level measurements, and the effect of production well pumping were found to have no influence on the resulting water table contour interpretation. The contour map and inferred groundwater flow paths presented in Figure 3 are considered an accurate representation of the aquifer flow system beneath WAG 5 and are most likely the result of heterogeneity in the aquifer.

The hydraulic gradient evaluation showed that measured water table elevations in the WAG 5 area range from 1,362 m (4,468 ft) in Well USGS 5 to 1,352 m (4,435 ft) in Well USGS 107 (see Figure 3). The depth to the water table ranges from 189 m (620 ft) in Well AREA-II to 139 m (455 ft) in Well USGS 82. Thus, the water table gradient varies widely beneath WAG 5. The general gradient is about 0.8 m/km (4 ft/mi) to the south and southwest. However, beneath the PBF area, the southeast gradient is fairly steep: approximately 4 m/km (23 ft/mi). A review of borehole deviation logs and barometric data collected during each quarterly measurement event indicated that neither of these two factors has a significant effect on the resulting water table contour interpretation (Holdren et al. 1999). In addition, an evaluation of the effects of pumping the PBF production wells, SPERT 1 and SPERT 2, indicated that local pumping is not causing the gradient beneath PBF (Holdren et al. 1999). Based on the available data, the steep water table gradient beneath PBF is most likely the result of aquifer

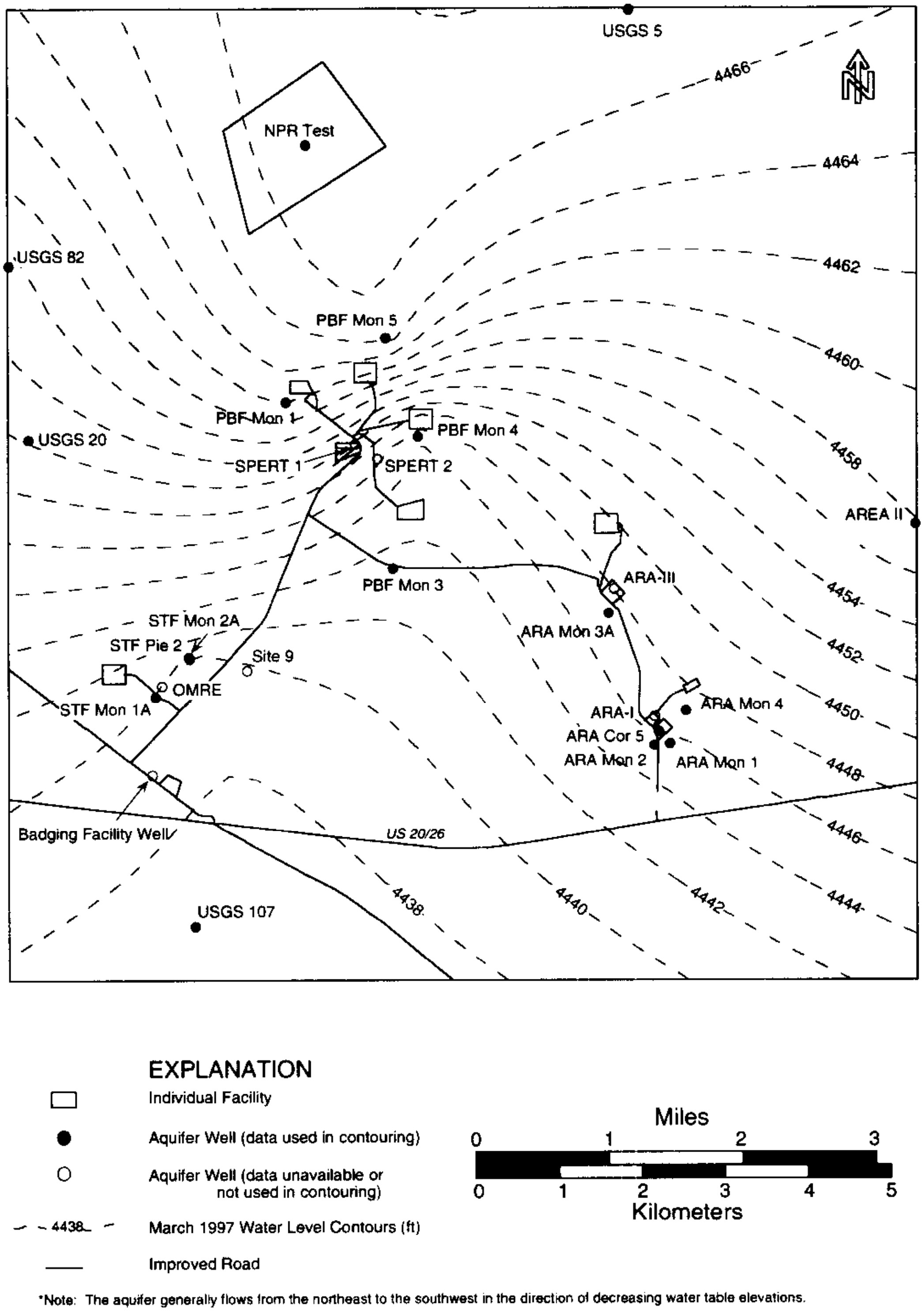

Figure 3. Groundwater gradient at WAG 5.

heterogeneity. The existing monitoring network is adequate, as shown by the SL-1 sensitivity analysis (Magnuson and Sondrup 1998) and because WAG 5 operations primarily generated surface contamination, not groundwater contamination.

Information obtained during quarterly water-level measurements (Neher 1997a) also indicates a potentially confined or semiconfined deeper portion of the aquifer in the WAG 5 area. Monitoring of the Site 9 well during the quarterly water-level measurements revealed a hydraulic head approximately 3.7 m (12 ft) higher than expected, given the water table elevation in surrounding wells. The higher hydraulic head in Site 9 is most likely caused by confined or semiconfined conditions at depth. This inference is supported by the presence of several thick clay layers observed at elevations between 1,310 m (4,300 ft) and 1,220 m (4,000 ft) in the well logs from the Site 9, SPERT 2, and Organic-Moderated Reactor Experiment wells.

5.2 Climate

Meteorological and climatological data for the INEEL and the surrounding region are collected and compiled from several meteorological stations operated by the National Oceanic and Atmospheric Administration field office in Idaho Falls, Idaho. Three stations are located at the INEEL.

Annual precipitation at the INEEL is light, with an annual average of 22.1 cm (8.7 in.). Therefore, the region is classified as arid to semiarid (Clawson, Start, and Ricks 1989). The rates of precipitation are highest during the months of May and June and lowest during July. Normal winter snowfall occurs from November through April, though occasional snowstorms occur in May, June, and October. Snowfall at the INEEL ranges from about 17.3 cm (6.8 in.) per year to about 151.6 cm (59.7 in.) per year, and the annual average is 70.1 cm (27.6 in.) (Clawson, Start, and Ricks 1989). The INEEL is subject to severe weather episodes throughout the year. Thunderstorms are observed mostly during the spring and summer. An average of two to three thunderstorms occurs during each of the months from June through August (EG&G 1981). Thunderstorms are often accompanied by strong gusty winds that may produce local dust storms. Precipitation from thunderstorms at the INEEL is generally light. Occasionally, however, rain resulting from a single thunderstorm on the INEEL exceeds the average monthly total precipitation (Bowman et al. 1984).

The moderating influence of the Pacific Ocean produces a climate at the INEEL that is usually warmer in the winter and cooler in summer than locations of similar latitude in the United States east of the Continental Divide. The mountain ranges north of the INEEL act as an effective barrier to the movement of most of the intensely cold winter air masses entering the United States from Canada. Occasionally, however, cold air spills over the mountains and is trapped in the plain. The INEEL then experiences below-normal temperatures usually lasting from 1 week to 10 days. The relatively dry air and infrequent low clouds permit intense solar heating of the surface during the day and rapid radiant cooling at night. These factors combine to give a large diurnal range in temperature near the ground. The average summer daytime maximum temperature is 28°C (83°F), while the average winter daytime maximum temperature is –0.6°C (31°F). Recorded temperature extremes at the INEEL vary from a low of –44°C (–47°F) in January to a high of 38°C (101°F) in July (Clawson, Start, and Ricks 1989).

The relative humidity at the INEEL ranges from a monthly average minimum of 18% during the summer months to a monthly average maximum of 55% during the winter. The relative humidity is directly related to diurnal temperature fluctuations. Relative humidity reaches a maximum just before sunrise (the time of lowest daily temperature) and a minimum in midafternoon (the time of maximum daily temperature) (Clawson, Start, and Ricks 1989).

The INEEL is in the belt of prevailing westerly winds, which are channeled within the Eastern Snake River Plain to produce a west-southwest or southwest wind approximately 40% of the time. Local mountain valley features exhibit a strong influence on the wind flow under other meteorological conditions as well. The average midspring windspeed recorded at a height of 6 m (20 ft) is 9.3 mph, while the average midwinter windspeed is 5.1 mph (Irving 1993).

5.3 Flora and Fauna

Six broad vegetation categories representing nearly 20 distinct habitats have been identified on the INEEL: juniper-woodland, native grassland, shrub-steppe off lava, shrub-steppe on lava, modified, and wetlands. Though small riparian and wetland regions exist along the Big Lost River and Birch Creek, (see Figure 1) nearly 90% of the Site, including WAG 5, is covered by shrub-steppe vegetation. Big sagebrush, saltbush, rabbitbrush, and native grasses are the most common varieties.

The INEEL serves as a wildlife refuge because a large percentage of the Site is undeveloped and human access is restricted. Grazing and hunting are prohibited in the central part of the Site. Mostly undeveloped, this tract may be the largest relatively undisturbed sagebrush steppe in the Intermountain West outside of the national parklands (DOE-ID 1996a). More than 270 vertebrate species including 43 mammalian, 210 avian, 11 reptilian, nine fish, and two amphibious species have been observed on the Site. During some years, hundreds of birds of prey and thousands of pronghorn antelope and sage grouse winter on the INEEL. Mule deer and elk also reside at the Site. Observed predators include bobcats, mountain lions, badgers, and coyotes. Bald eagles, classified as a threatened species, are commonly observed on or near the Site each winter. Peregrine falcons, recently removed from the federal endangered species list, also have been observed. In addition, other species that are candidates for listing as threatened or endangered by the U.S. Fish and Wildlife Service may either inhabit or migrate through the area. Candidate species that may frequent the area include ferruginous hawks, pygmy rabbits, Townsend's big-eared bats, burrowing owls, and loggerhead shrikes.

At ARA and PBF, trees are sparse and no surface water features exist to attract wildlife. No ecologically sensitive areas (i.e., areas of critical habitat) are located in WAG 5 (Holdren et al. 1997).

5.4 Demography

The populations potentially affected by INEEL activities include INEEL employees, ranchers who graze livestock in areas on or near the INEEL, hunters on or near the Site, residential populations in neighboring communities, and highway travelers.

Nine separate facilities at the INEEL include a total of approximately 450 buildings and more than 2,000 other support facilities. In January 1996, the INEEL employed 8,616 contractor and government personnel. Approximately 60% of the total work force is employed at the INEEL Site and 40% is located in Idaho Falls, Idaho (DOE-ID 1996a). According to DOE-ID (1996a), as of 1996, approximately 112 employees were working at PBF. The ARA is not an active facility. Decommissioning and dismantlement crews have been working at ARA-I, -II, and –III, and personnel occasionally visit ARA-IV. However, a full-time staff is not maintained at ARA. Employee totals at other INEEL locations in 1996 included approximately 190 at the RWMC, 883 at the Central Facilities Area, 360 at Test Area North, 470 at the Test Reactor Area, 1,300 at the Naval Reactors Facility, 1,162 at the Idaho Nuclear Technology and Engineering Center, 750 at Argonne National Laboratory–West, and 10 within the remaining Site-wide areas, which include the ARA. In addition, approximately 3,400 INEEL employees occupy numerous offices, research laboratories, and support facilities in Idaho Falls (DOE-ID 1996a).

The INEEL Site is bordered by five counties: Bingham, Bonneville, Butte, Clark, and Jefferson. Major communities include Blackfoot and Shelley in Bingham County, Idaho Falls and Ammon in Bonneville County, Arco in Butte County, and Rigby in Jefferson County. The nearest community to the INEEL is Atomic City, located south of the Site border on U.S. Highway 26. Other population centers near the INEEL include Arco, 11 km (7 mi) west of the Site; Howe, west of the Site on U.S. Highway 22/33; and Mud Lake and Terreton on the northeast border of the Site.

5.5 Cultural Resources

Over the past two decades, detailed inventories of cultural resources at some parts of the INEEL have been assembled. Initial surveys have been focused on areas within and around major operating facilities at the Site. Proposed future construction areas also have been examined. As of January 1, 1998, approximately 6.6% (37,681 acres) of the 2,305-km^2 (890-mi^2) INEEL has been systematically surveyed for archaeological resources and 1,839 archaeological localities have been identified. The inventory includes prehistoric resources representing a span of approximately 12,000 years as well as historic resources representing the last 150 years. Cultural resources on the INEEL also include a number of more recent buildings, structures, and objects that have made significant contributions to the broad patterns of American history through the Site's association with World War II, the Cold War, and important advances in nuclear science and technology. One INEEL facility, the Experimental Breeder Reactor I, is recognized as a national historic landmark.

The experiments conducted within the PBF complex in the 1960s and early 1970s provided the nuclear industry with information needed for the design and safe operation of boiling water, pressurized water, heavy water, and open pool reactors. In a preliminary survey of buildings administered by DOE-ID (Arrowrock 1997), 16 of the 27 buildings associated with the PBF experiments are potentially eligible for nomination to the National Register of Historic Places. Detailed historical documentation must be completed in the event of proposed demolition or major structural modification to any of these 16 buildings. Such documentation must be formalized through a memorandum of agreement between DOE-ID and the State Historic Preservation Office.

Many cultural resource investigations have been completed in the WAG 5 area (Miller 1995). Activities have included archaeological surveys (Reed et al. 1987) and test excavations (Ringe 1988), excavations of sensitive Native American burial sites (Miller 1994, 1997), historic building inventories (Arrowrock 1997), and the development of detailed documentation (DOE-ID 1993).

Since 1984, six major archaeological survey projects encompassing nearly 1,200 acres have been completed in the PBF area. As a result, 86 sensitive resources have been identified within or immediately adjacent to the fenced perimeter of the facility. Resources include hunting campsites and game processing areas, stone-tool processing areas, hunting blinds made of locally available basalt cobbles, and Native American burial sites. Shoshone-Bannock tribal members have indicated that the sandy ridges and basins so common to WAG 5 may contain additional areas of traditional cultural importance. Limited archaeological test excavations completed in 1988 and intensive investigations of Native American human remains discovered in 1994 and 1996 at PBF provide further evidence of the sensitivity of the area and indicate a high potential for stratified subsurface cultural deposits, even in areas where no surface indications are apparent.

Relatively recent archaeological surveys of the ARA facilities have revealed a number of significant archaeological resources. Examination of 255 acres within and around the fenced facility perimeters has resulted in the preliminary documentation of 14 sensitive archaeological resources. Generally, these resources are very similar to those identified within the PBF area, though no Native American burial sites have been discovered at the ARA.

Local Native American people, particularly the Shoshone-Bannock tribal members of Fort Hall, Idaho, view all of the prehistoric sites on the INEEL as ancestral and of traditional cultural significance. A variety of natural features also are important to Native Americans. Though rare on the INEEL, Native American burial sites are of special concern. Tribal representatives will be consulted to ensure that no significant resources are inadvertently harmed by remedial activities at WAG 5.

5.6 Conceptual Site Models

The conceptual site models for WAG 5 reflect the types of receptors that could be affected by exposures to contaminants in the area. Two human health conceptual site models were developed and are illustrated graphically in Figures 4 and 5. One model represents a hypothetical future residential scenario beginning 100 years in the future, and the other reflects current and future occupational scenarios. The models are based on land-use assumptions and the exposure assessment conducted for the WAG 5 Comprehensive RI/FS (Holdren et al. 1999). Further discussion of INEEL land use appears in Section 6, and the exposure assessment is summarized in Section 7. The human health conceptual site models reflect the following land-use assumptions:

- The INEEL will remain under government ownership and institutional control for at least the next 100 years (i.e., until the year 2095, 100 years from the date of INEEL land-use projections [DOE-ID 1996])
- No residential development (e.g., housing) will occur within the INEEL boundaries within the institutional control period.

The conceptual site models for the ecological risk assessment reflect the locations of contaminated media that ecological receptors may be exposed to surface sediments comprising the top 0.15 m (0.5 ft) of soil and subsurface soil. The complete ecological conceptual site model is shown pictorially in Figure 6. The two components of the model are illustrated graphically in Figures 7 and 8, and a summary of the exposure media and ingestion routes for INEEL ecological receptors is given in Table 1.

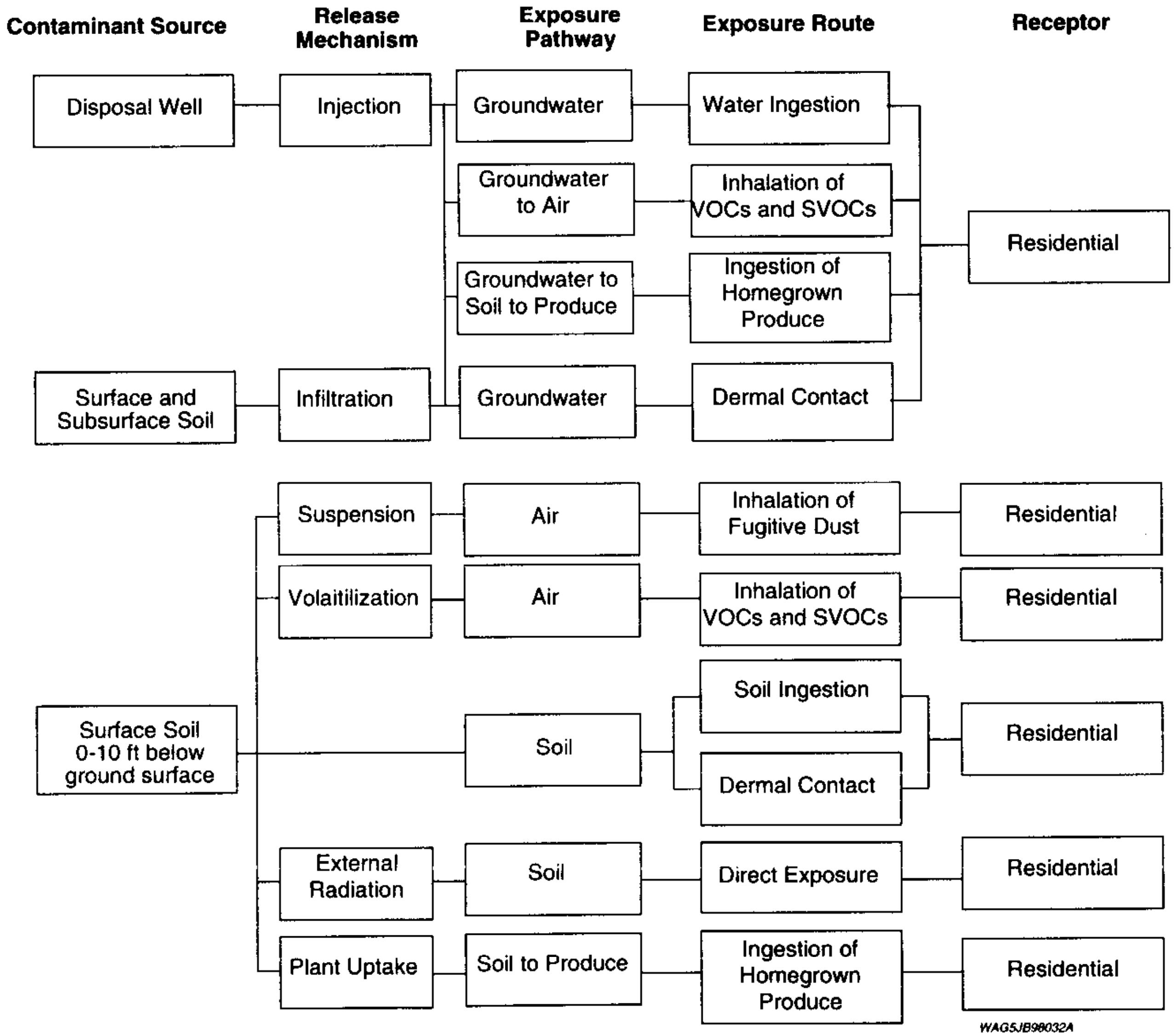

Figure 4. Human health conceptual site model for the hypothetical future residential scenario beginning in 2095.

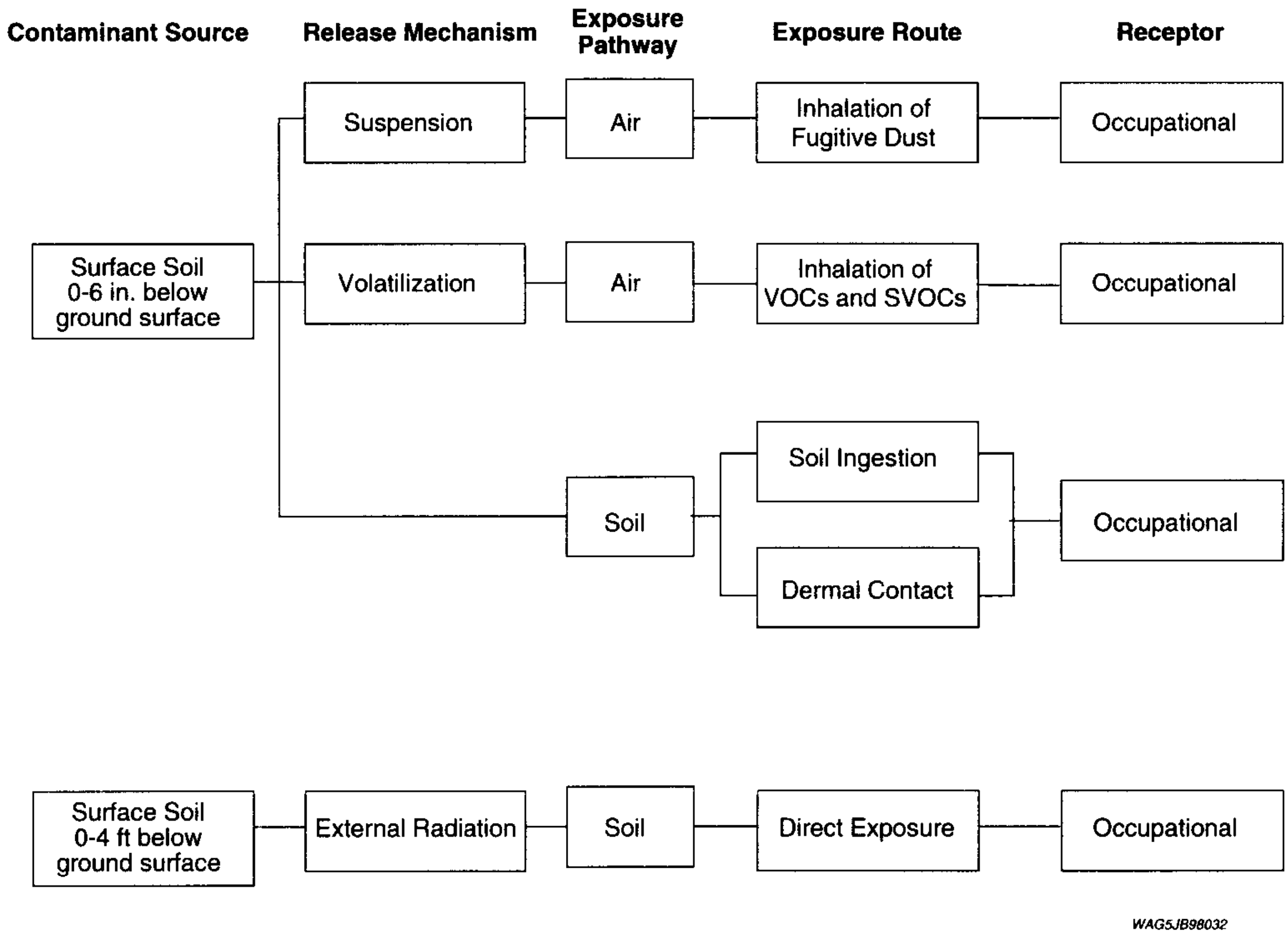

Figure 5. Human health conceptual site model for the current and future occupational scenarios.

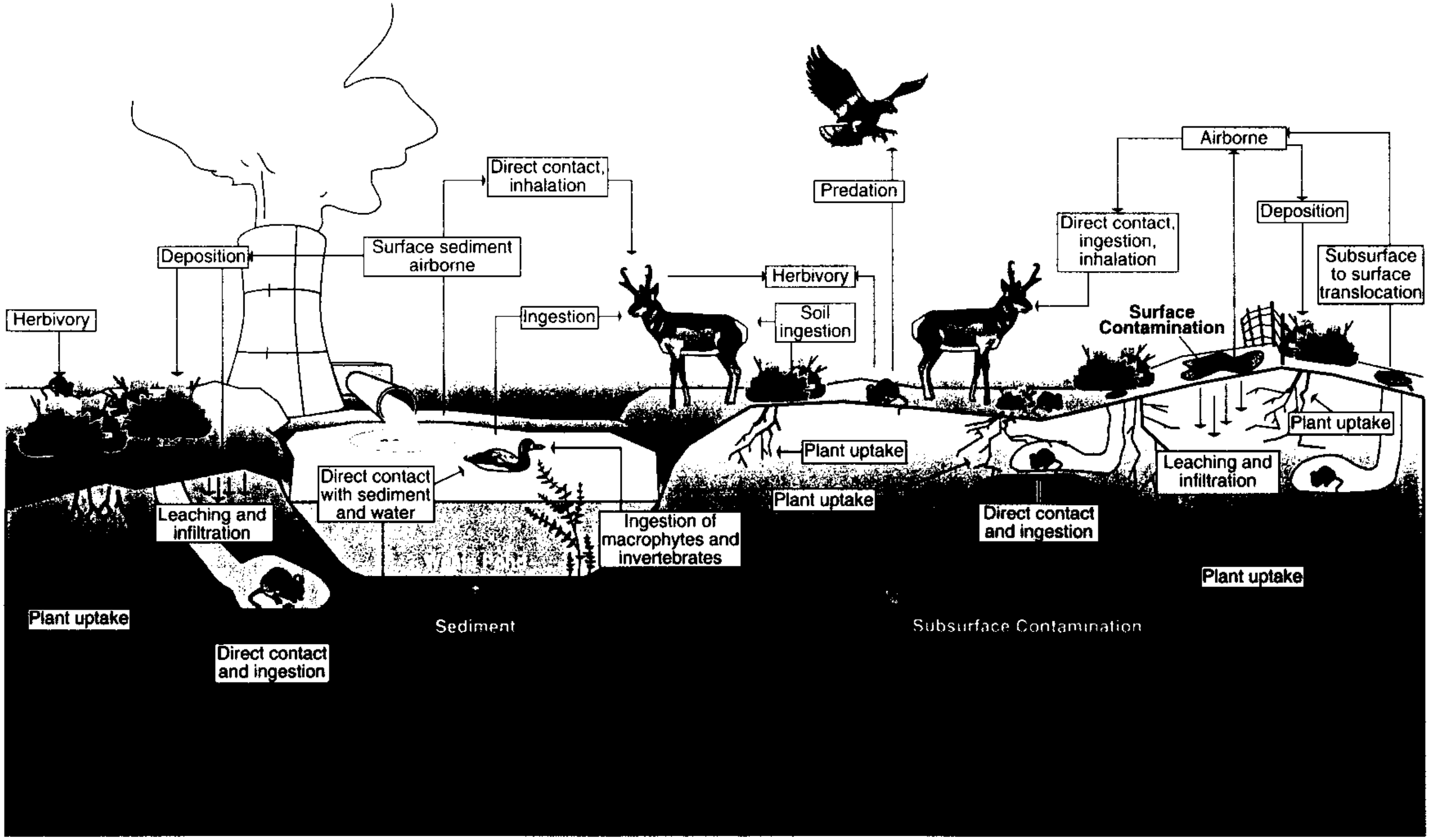

Figure 6. Ecological conceptual site model.

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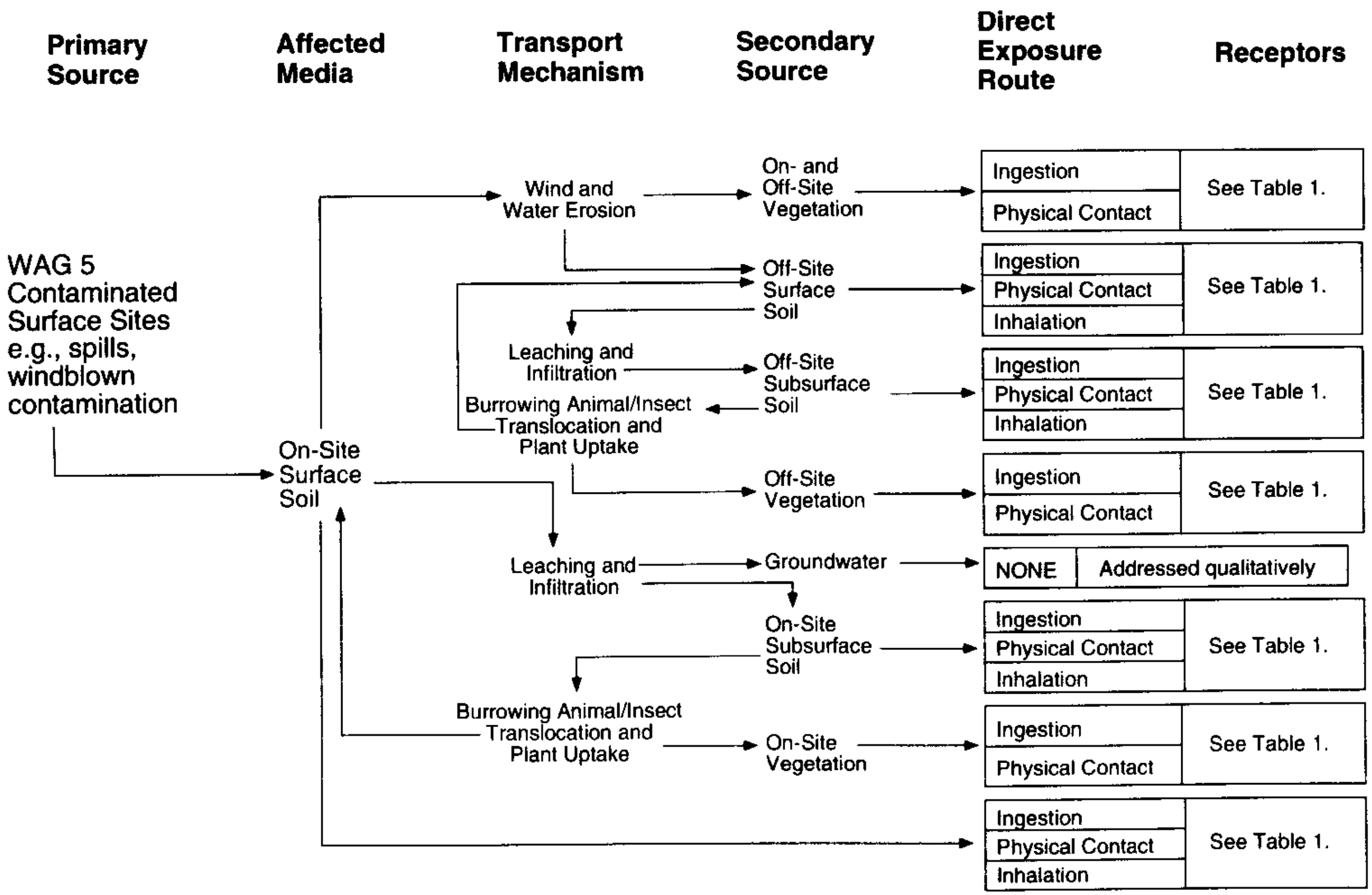

Figure 7. Model for screening level ecological risk assessment pathways and exposure for WAG 5 surface contamination.

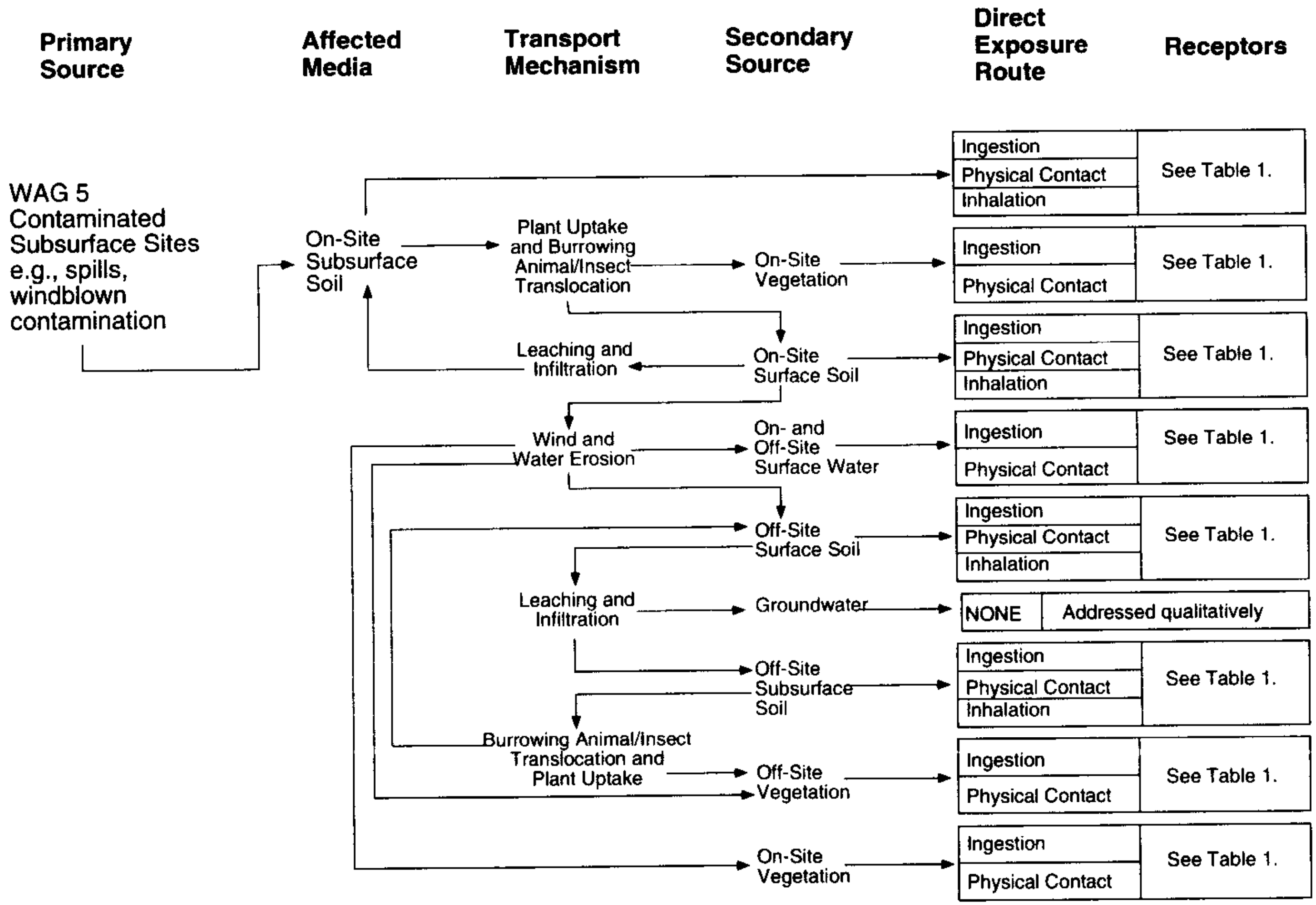

Figure 8. Model for screening level ecological risk assessment pathways and exposure for WAG 5 subsurface contamination.

Table 1. Summary of WAG 5 exposure media and ingestion routes for INEEL functional groups.

Receptor	Surface Soil	Subsurface Soil	Vegetation	Sediment	Prey Consumption Invertebrates	Mammals	Birds
Avian herbivores (AV122)	X						
Avian insectivores (AV210A)				X	X		
Avian insectivores (AV222)	X				X		
Avian insectivores (AV232)				X	X		
Avian carnivores (AV310)	X					X	X
Northern goshawk	X					X	X
Peregrine falcon	X					X	
Avian carnivores (AV322)						X	
Bald eagle						X	
Ferruginous hawk						X	
Loggerhead shrike						X	X
Avian carnivores (AV322A) Burrowing owl	X	X			X	X	
Avian omnivores (AV422)			X		X	X	X
Mammalian herbivores (M122)	X		X				
Mammalian herbivores (M122A)	X	X	X				
Pygmy rabbit	X	X	X				
Mammalian insectivores (M210A)	X				X		
Townsend's western big-eared bat	X				X		
Small-footed myotis	X				X		
Long-eared myotis					X		
Mammalian insectivores (M222) Merriam's shrew	X			X	X		
Mammalian carnivore (M322)	X					X	
Mammalian omnivores (M422)	X	X	X		X		
Reptilian carnivores (R322)						X	
Plants							

6. CURRENT AND POTENTIAL FUTURE SITE AND RESOURCE USES

The INEEL land area consists of approximately 2,305 km^2 (890 mi^2) (230,266 ha [569,000 acres]). The majority of this land, approximately 98%, has not been disturbed by Site operations. Land use on the entire INEEL is restricted, and access to the INEEL and WAG 5 is controlled. Though public highways traverse the INEEL, public access beyond the highway right-of-way is not allowed. Access to INEEL facilities requires proper clearance, training or an escort, and controls to limit exposures. Current land use and projections are summarized below.

6.1 Current Land Use

The acreage within the INEEL is classified as industrial and mixed use by the Bureau of Land Management (DOE-ID 1996a). Typical INEEL land use consists of wildlife management areas, government industrial operations areas, and waste management areas. No residential areas are contained within the INEEL boundaries. As shown in Figure 9, large tracts of land are reserved as buffer and safety zones around the boundary of the INEEL, and operations are generally restricted to the central area. Aside from the operational facilities, the remaining land within the core of the Site is largely undeveloped and is used for environmental research, ecological preservation, and sociocultural preservation. Any future construction of new facilities at the INEEL likely will occur within the preferred development corridors.

The buffer consists of 1,295 km^2 (500 mi^2) of grazing land (DOE-ID 1996a) administered by the Bureau of Land Management. Grazing areas at the INEEL support cattle and sheep, especially during dry conditions. Depredation hunts of game animals managed by the Idaho Department of Fish and Game are permitted on the INEEL within the buffer zone during selected years (DOE-ID 1996a). Hunters are allowed access to an area that extends 0.8 km (0.5 mi) inside the INEEL boundary on portions of the northeastern and western borders of the Site (DOE-ID 1997a).

State Highways 22, 28, and 33 cross the northeastern portion of the Site, and U.S. Highways 20 and 26 cross the southern portion (Figure 1). One hundred forty-five km (90 mi) of paved highways used by the general public pass through the INEEL (DOE-ID 1996a), and 23 km (14 mi) of Union Pacific Railroad tracks traverse the southern portion of the Site. A government-owned railroad passes from the Union Pacific Railroad through the Central Facilities Area to the Naval Reactors Facility, and a spur runs from the Union Pacific Railroad to the RWMC.

In the counties surrounding the INEEL, approximately 45% of the land is used for agriculture, 45% is open land, and 10% is urban (DOE-ID 1996a). Livestock uses include the production of sheep, cattle, hogs, poultry, and dairy cattle (Bowman et al. 1984). The major crops produced on land surrounding the INEEL include wheat, alfalfa, barley, potatoes, oats, and corn. Sugarbeets are grown within about 40 mi of the INEEL in the vicinity of Rockford, Idaho, southeast of the INEEL in central Bingham County (Idaho 1996). Most of the land surrounding the INEEL is owned by private individuals or the U.S. government. The Bureau of Land Management (BLM) administers the government land on the INEEL (DOE-ID 1996a).

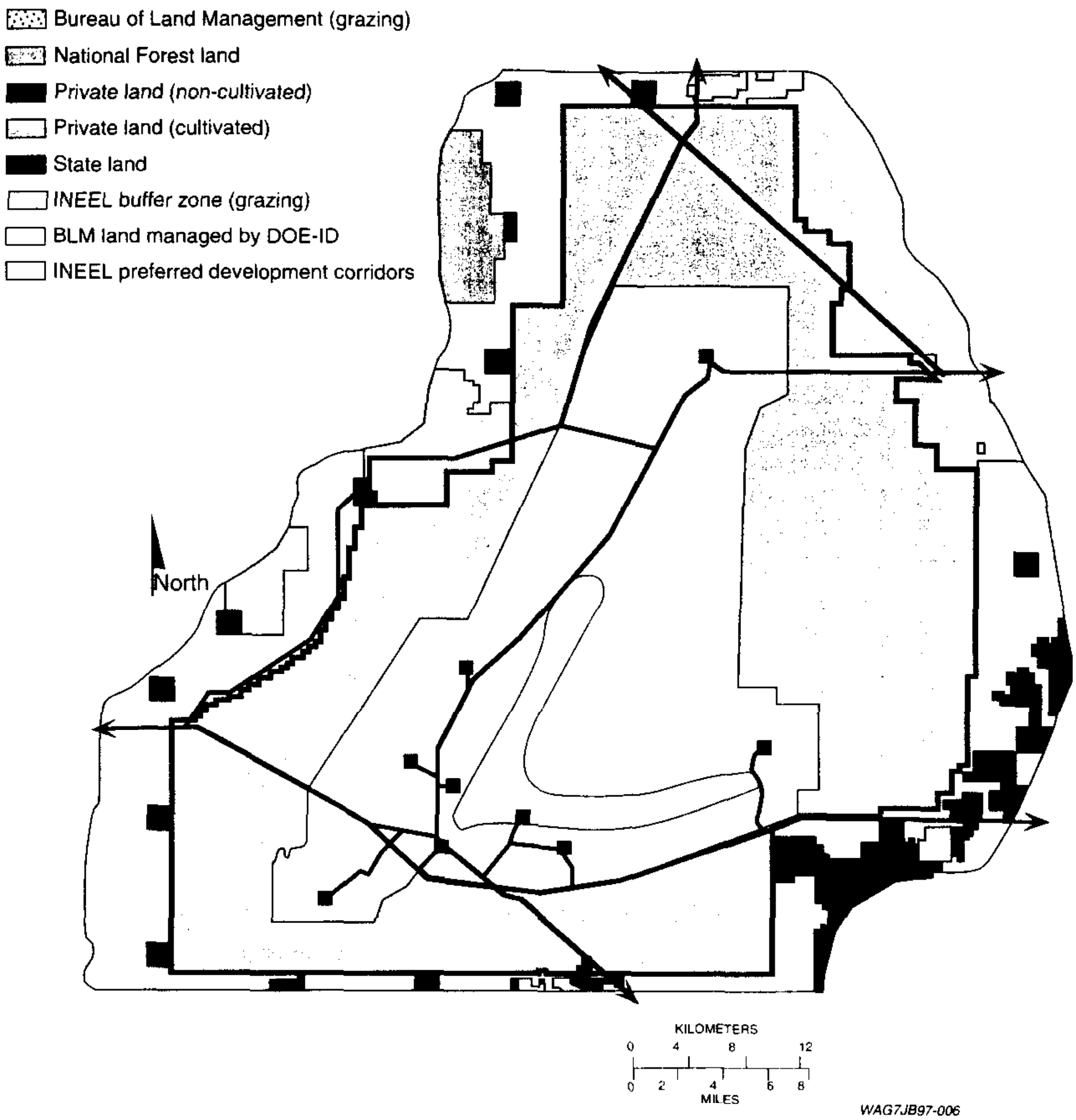

Figure 9. Land ownership distribution in the vicinity of the INEEL (DOE-ID 1996a).

6.2 Future Land Use

The projections for future land use at the INEEL area are influenced by the following assumptions and factors (DOE-ID 1996a):

- Department of Energy projections for the future of its national laboratory research and development activities and nuclear reactor programs
- The presence of active industrial and research facilities
- The presence of an industrial infrastructure
- The likely inability to "green field" (e.g., return to natural state with unrestricted land use) the industrial complex without total removal
- All land use, with the exception of grazing by permit, will be industrial
- Recommendations from the INEEL Citizen's Advisory Board and other stakeholders about future use assumptions.

Land-use projections in the INEEL Comprehensive Facility Land Use Plan (DOE-ID 1996a) incorporate the assumption that the INEEL will remain under government management and control for at least the next 100 years. Therefore, the baseline risk assessment (Holdren et al. 1999) simulates a hypothetical residential scenario beginning in 100 years. However, implementation of this management and control becomes increasingly uncertain over this time period. Regardless of the future use of the land now occupied by the INEEL, the federal government has an obligation to provide adequate institutional controls (i.e., limit access) to areas that pose significant health or safety risks until those risks diminish to acceptable levels (see Section 11). Fulfillment of this obligation hinges on the continued viability of the federal government and on Congress appropriating sufficient funds to maintain the institutional controls for as long as necessary.

A mix of land uses across the INEEL is anticipated to include unrestricted industrial uses, government-controlled industrial uses, unrestricted areas, controlled areas for wildlife management and conservation, and waste management areas. No residential development will be allowed within INEEL boundaries, and no new major private developments (residential or nonresidential) on public lands are expected in areas adjacent to the Site. Grazing will be allowed to continue in the buffer area (DOE-ID 1996a).

The Land Use Plan (DOE-ID 1996a) was developed using a stakeholder process that involved a public participation forum, a public comment period, and the INEEL Citizens' Advisory Board. The public participation forum membership included members from the local counties and cities, the Shoshone-Bannock Tribes, the Bureau of Land Management, DOE, the U.S. Forest Service, the U.S. National Park Service, the Idaho Department of Transportation, Idaho Fish and Game, and eight business, education, and citizen organizations. In addition, the EPA and IDHW participated in an ex-officio capacity. Following review and comment by the public participation forum, the document underwent a 30-day public comment period and was subsequently submitted to the INEEL Citizen's Advisory Board for review and recommendations. No recommendations for residential use of any portions of the INEEL within at least the next 100 years have been received to date. Projected nonindustrial use is limited to grazing and similar activities. In addition, the INEEL is currently a National Environmental Research Park and is expected to remain so for the foreseeable future.

Generally, future land use within the INEEL will remain essentially the same as the current use: a research facility within the INEEL boundaries and agriculture and open land surrounding the INEEL. Other potential but less likely land use within the INEEL includes agricultural applications and the return of the areas to their natural undeveloped states. The INEEL Land Use Plan (DOE-ID 1996a) projects that the ARA will be encompassed by a future buffer to public roads (i.e., State Highway 20) and will not be reused for future INEEL operations. Conversely, the forecast for the PBF area includes modification and reuse for industrial operations over the next 100 years (DOE-ID 1996a).

6.3 Groundwater Uses

Current use of groundwater from the Snake River Plain Aquifer is for drinking and irrigation. Groundwater is extracted from two production wells at PBF. Groundwater use at ARA has been discontinued. Restrictions on groundwater use based on the impacts of WAG 5 operations on the aquifer are not anticipated. Aquifer contamination originating at WAG 5 has not been identified and, as discussed in Section 7.3, fate and transport modeling does not indicate that future contamination in excess of risk-based concentrations from sources at the ARA and PBF will occur.

6.4 Groundwater Classification and Basis

The ARA and PBF facilities are situated above the Snake River Plain Aquifer. The eastern portion of the aquifer was granted sole source status by the EPA on October 7, 1991 (56 FR 50634). Idaho water quality standards are dictated primarily by the Idaho Ground Water Quality Rule (IDAPA 16.01.11), the Idaho Ground Water Quality Standards (IDAPA 16.01.11.200), and the Idaho Water Quality Standards and Wastewater Treatment Requirements (IDAPA 16.01.02). These standards and requirements can be accessed at the Internet address "www.idwr.state.id.us/apa/idapa."

Three categories of protectiveness apply to the aquifer and its associated resources under Idaho regulations: (1) Sensitive Resources, (2) General Resources, and (3) Other Resources. Because no previous action to categorize the Snake River Plain Aquifer under Idaho regulations has occurred, the aquifer defaults to the "General Resources" category. General Resource aquifers are protected to ensure that groundwater quality is not jeopardized. Idaho's groundwater standards incorporate federal radiation exposure and drinking water standards (10 CFR 20, Appendix B, Table 2, and 40 CFR 141 and 143). When the two federal standards are not in agreement, the more restrictive standard applies.